CLAIMS

1. A warm up device for a catalytic reactor (3-5) for use with a fuel cell power plant which comprises a plurality of catalytic reactors (3-5) each of which contains a catalyst, and a gas passage (27, 28) for connecting the catalytic reactors (3-5) in series, the warm up device comprising:

a burner (6) for producing combustion gas by burning fuel in order to warm the catalysts upon start up of the fuel cell power plant; and

combustion gas supply passages (71-73) for distributing the combustion gas individually to the catalytic reactors (3-5).

2. The warm up device as defined in Claim 1, wherein the burner (6) comprises a lean burn burner (6) for burning a mixture of fuel and air at a larger air-fuel ratio than a stoichiometric air-fuel ratio.

3. The warm up device as defined in Claim 1, wherein an activation temperature of a catalyst contained in a catalytic reactor (3-5) is different from an activation temperature of a catalyst contained in a different catalytic reactor (3-5).

4. The warm up device as defined in any one of Claim 1 through Claim 3, wherein the warm up device further comprises a heat amount supply adjustment mechanism (22, 23, 80) for reducing differences among the reactors (3-5) in relation to a timing at which the catalyst reaches an activation temperature.

5. The warm up device as defined in Claim 4, wherein the heat amount supply adjustment mechanism (22, 23, 80) comprises a valve (22, 23) which is capable of supplying air to one of the combustion gas supply passages (71-73).

6. The warm up device as defined in Claim 5, wherein the warm up device further comprises a sensor (52, 53) for detecting a catalyst temperature of a specific catalytic converter (4, 5) which is connected to the one of the combustion gas supply passages (71-73) and a controller (82) functioning to: calculate from the catalyst temperature detected prior to combustion gas distribution an amount of heat required to warm the catalyst to activation temperature (S2), compare the heat amount with a preset design warm up heat amount (S3, S5), and control the valve (22, 23) such that air is supplied to the specific catalytic converter (4, 5) when the heat amount is smaller than the design warm up heat amount.

7. The warm up device as defined in Claim 4, wherein the heat amount supply adjustment mechanism (22, 23, 80) comprises a valve (80) which is capable of increasing and decreasing a combustion gas flow rate in one of the combustion gas supply passages (71-73).

8. The warm up device as defined in Claim 7, wherein the warm up device further comprises a sensor (51-53) for detecting the catalyst temperature of each of the catalytic converters (3-5), and a controller (82) functioning to: calculate from the catalyst temperature of each of the catalytic reactors (3-5) detected prior to combustion gas distribution an amount of heat required to warm the catalyst in

each of the catalytic reactors (3-5) to the activation temperature (S12), compare a heat amount ratio of the amount of heat required to warm up the catalyst in a catalytic reactor (5) which is supplied with combustion gas through the valve (80) and the amount of heat required to warm up the catalyst in a different catalytic reactor (3, 4) with a preset design heat amount ratio (S13, S15), and control the valve (80) to cause the combustion gas flow rate to decrease when the heat amount ratio is smaller than the preset design heat amount ratio.

9. The warm up device as defined in Claim 8, wherein the controller (82) further functions to control the valve (80) to cause the combustion gas flow rate to increase when the heat amount ratio is larger than the design heat amount ratio (S16).

10. The warm up device as defined in any one of Claim 1 through Claim 3, wherein the catalytic reactors (3-5) comprise a reformer (3) for reforming fuel to produce reformate gas containing hydrogen and carbon monoxide, a shift converter (4) for reducing by shift conversion the carbon monoxide concentration in the reformate gas which flows therein from the reformer (3) through the gas passage (27, 28), and a preferential oxidation reactor (5) for reducing by a preferential oxidation reaction the carbon monoxide concentration in the reformate gas which flows therein from the shift converter through the gas passage (27, 28), and the combustion gas supply passages (71-73) comprise a combustion gas passage (71) for distributing combustion gas to the reformer (3) and a combustion gas passage (72) for distributing combustion gas to the preferential oxidation reactor (5).

11. The warm up device as defined in any one of Claim 1 through Claim 3, wherein the power plant upon start up is operated with a start up load which is smaller than a load during normal operation, and the warm up device is arranged to warm up the catalyst of each of the catalytic reactors (3-5) for a limited time corresponding to a proportion of the start up load and the load during normal operation.